

Applied Reflexion® LK Prime™ CMP System

Enabling High-Volume Manufacturing of
Advanced 3D Microchips

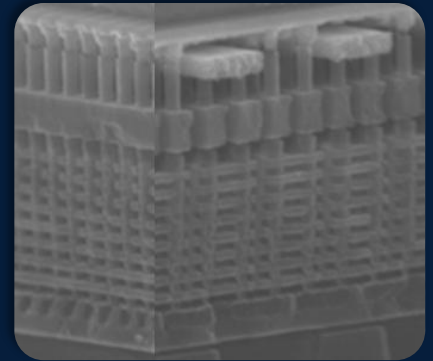
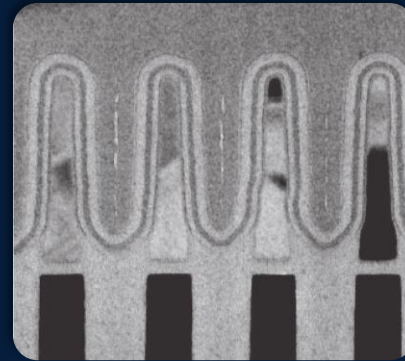
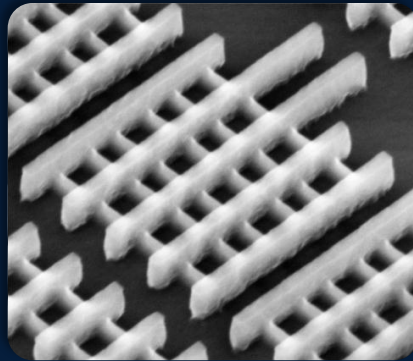
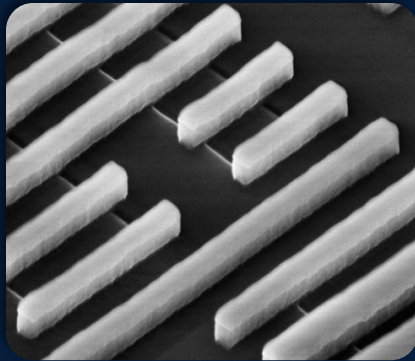


July 7, 2014

Transistors Transitioning from Planar to 3D

Planar Logic → 3D FinFET

2D NAND → 3D NAND



Chemical Mechanical Planarization (CMP) controls device performance

More complex sequence demands higher productivity

- Nanometer-level uniformity required
- Up to 10 additional CMP steps
- Planarization and process stability required for extremely long polish
- Up to 5 additional CMP steps

Comprehensive capabilities needed to meet requirements

Images Source: Public announcements and conference publications

CMP: Key Enabler of 3D Device Fabrication

- On-Wafer Performance
 - ▶ Improved uniformity
 - ▶ Fewer defects
- Flexibility
 - ▶ Application-specific processes
- Extendibility
 - ▶ Multi-generation capabilities
- Productivity
 - ▶ More wafers, less fab space

Better on-wafer results enable new device architectures

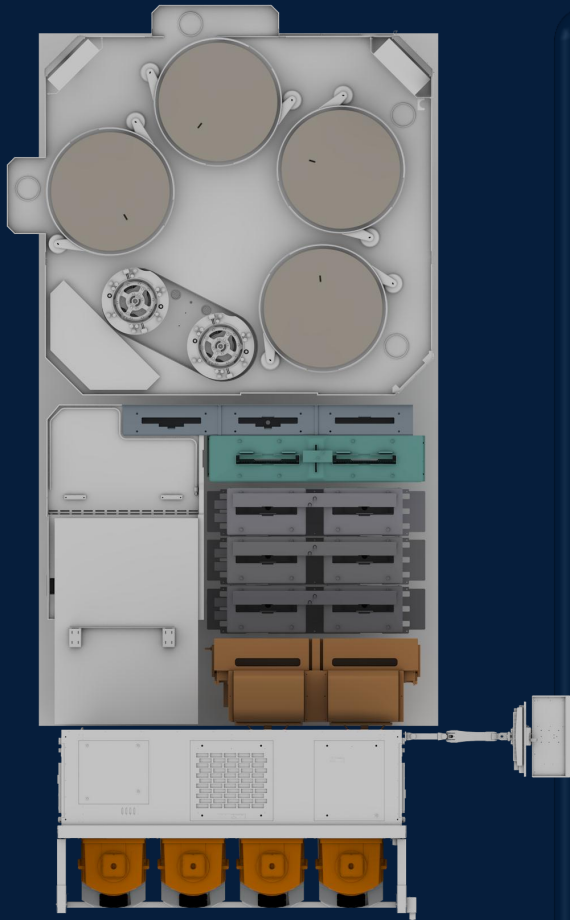
Applied Reflexion® LK Prime™ CMP System

Sets new performance and productivity benchmarks for fabricating FinFET and 3D NAND devices.



Comprehensive CMP solution for next-generation devices

Enabling Technology for 3D Devices



- **Titan Edge™** polishing head improves removal uniformity
- **Enhanced FullVision™** process control
- New **pre-cleaning module** reduces defectivity
- Real-time process control for **new materials**
- **14** processing stations (polishing + cleaning)
- **Optimized** wafer handling

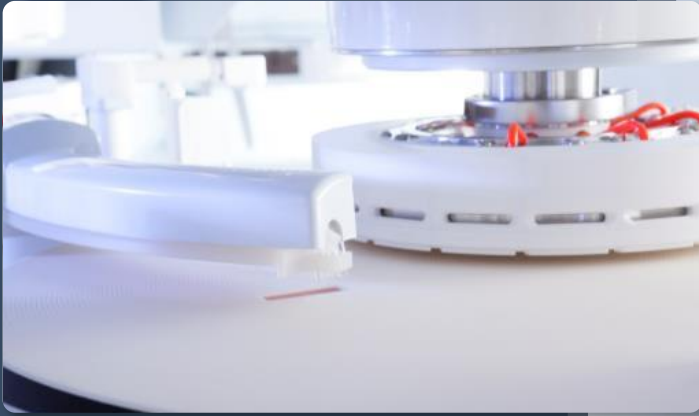
Flexible, extendible CMP for advanced architectures

Improved Productivity and Flexibility



- **Distributed** processing improves stability and polish precision
- **Sequential** processing enables multi-step applications
- **Parallel** processing improves productivity

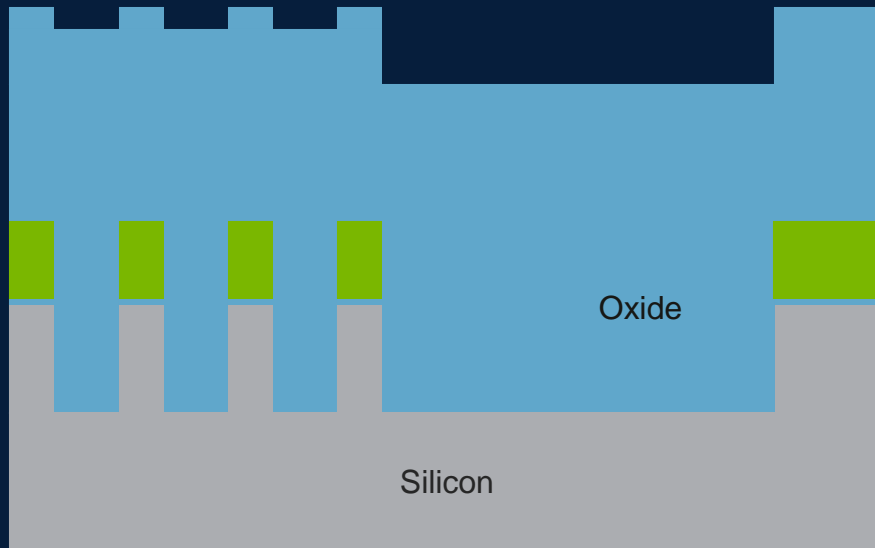
The Platform for the Future



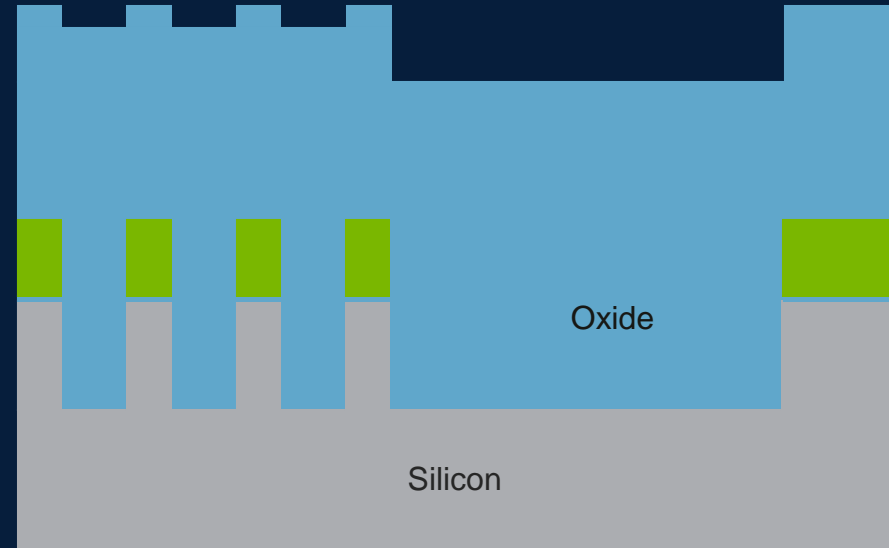
Designed to enable 3D device architectures

Smoother Topography

Single Step



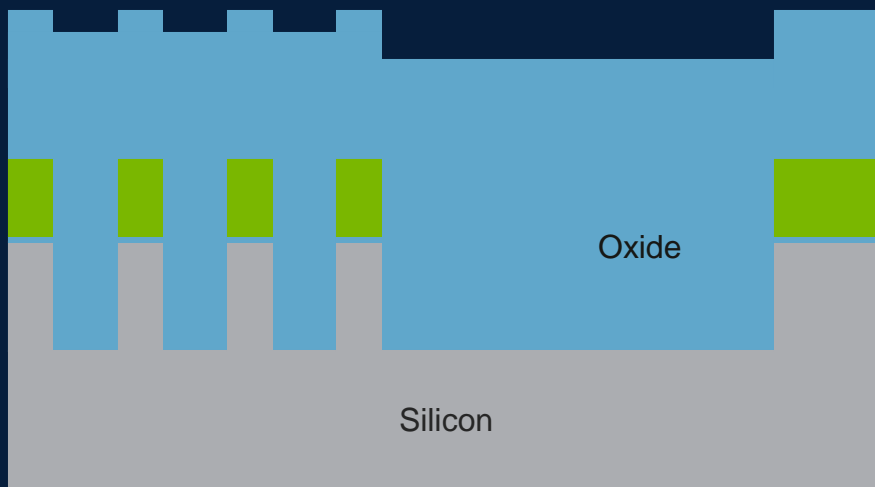
Multi-Step



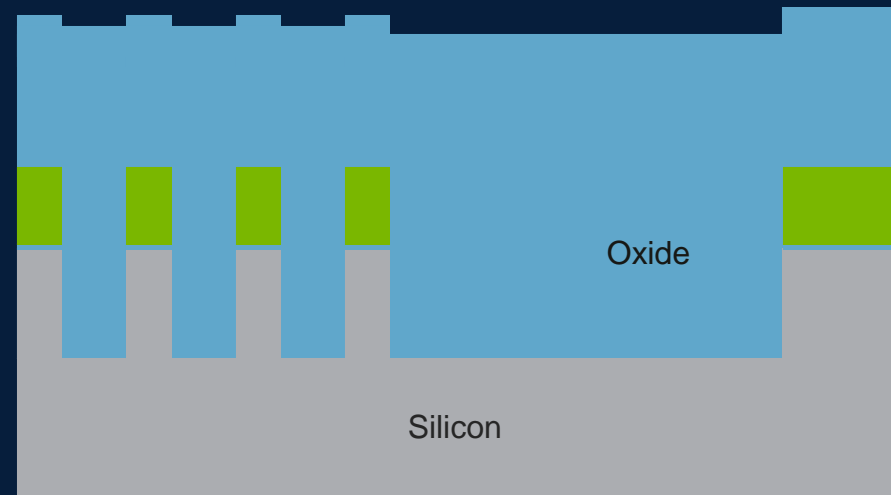
Multi-step polishing **stabilizes removal rate and profile**

Smoother Topography

Single Step



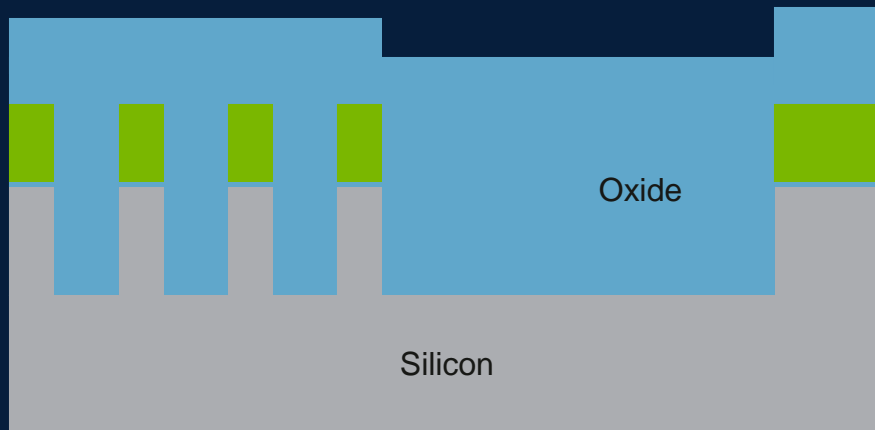
Multi-Step



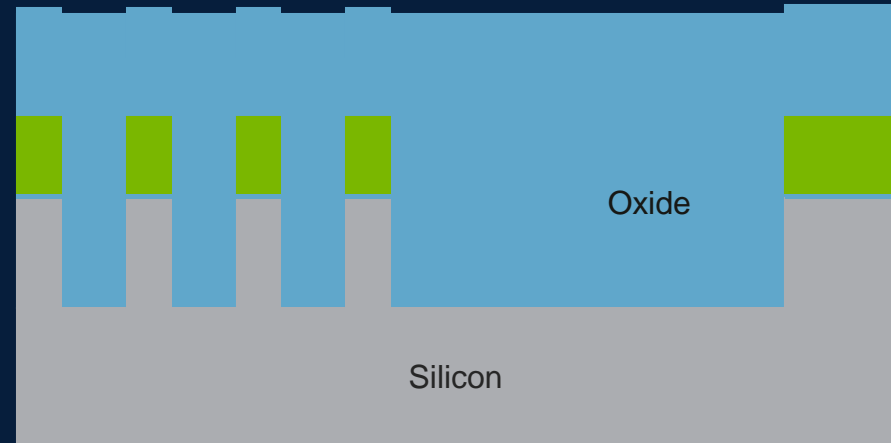
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Smoother Topography

Single Step



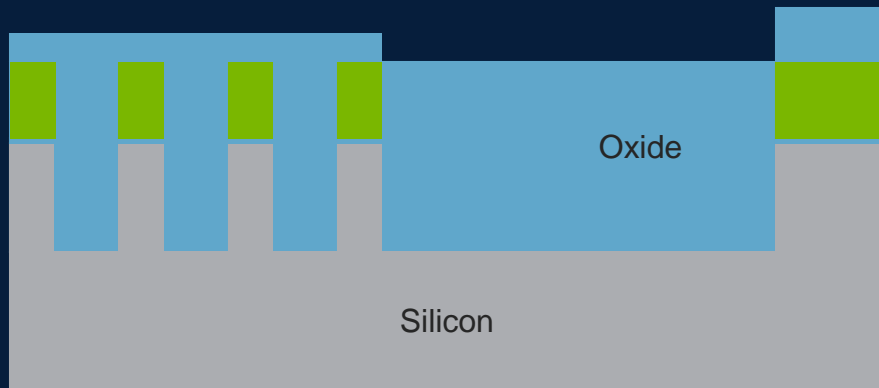
Multi-Step



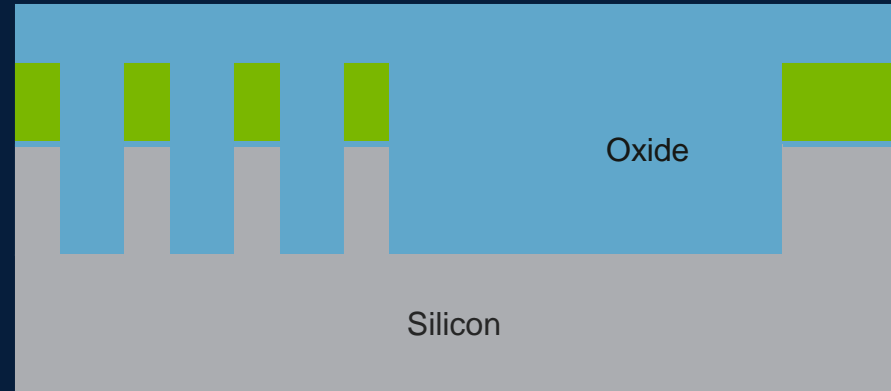
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Single Step



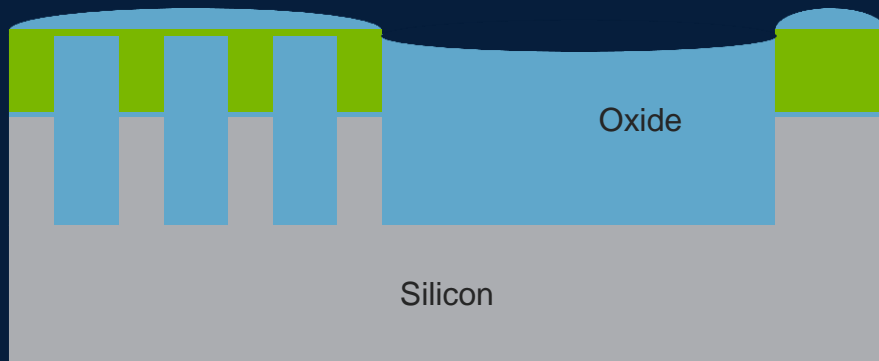
Multi-Step



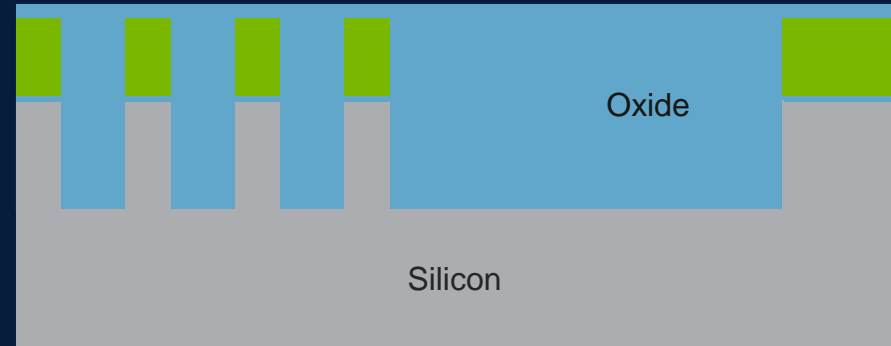
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Single Step



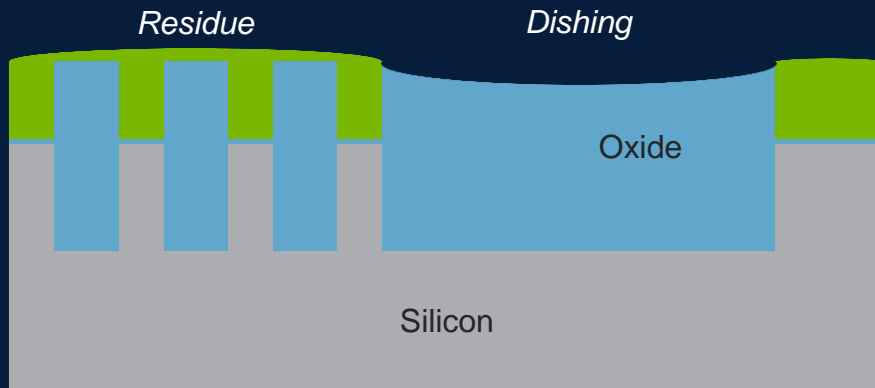
Multi-Step



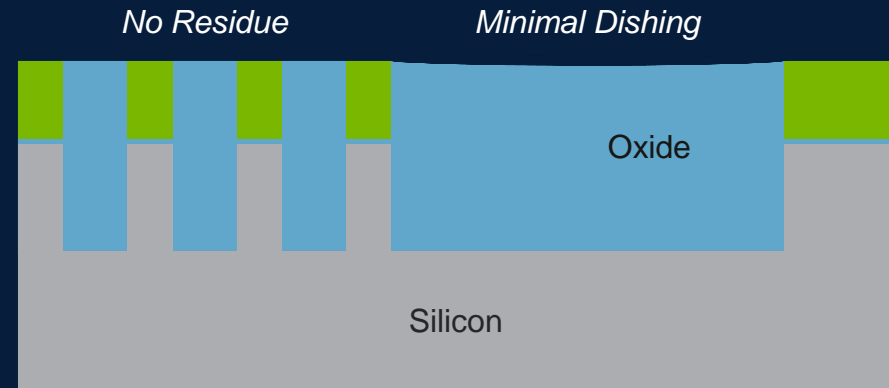
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Single Step



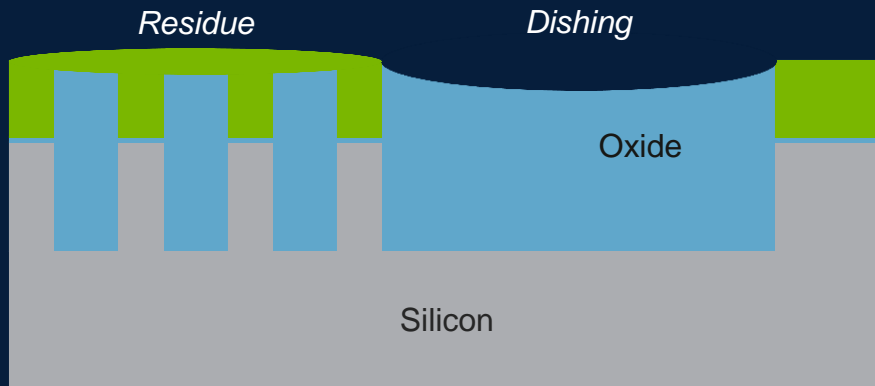
Multi-Step



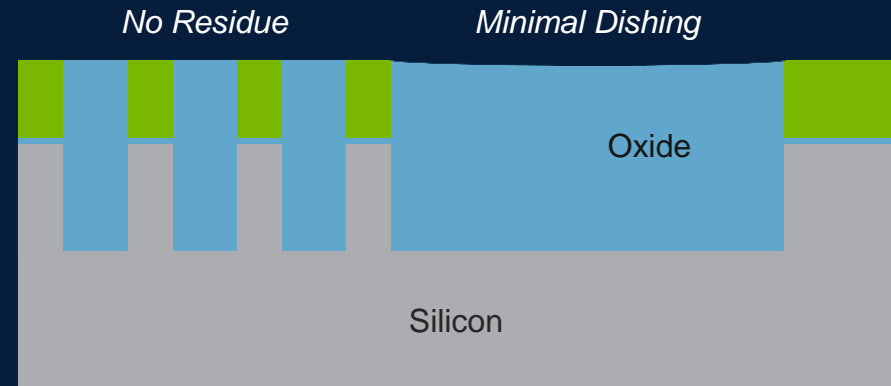
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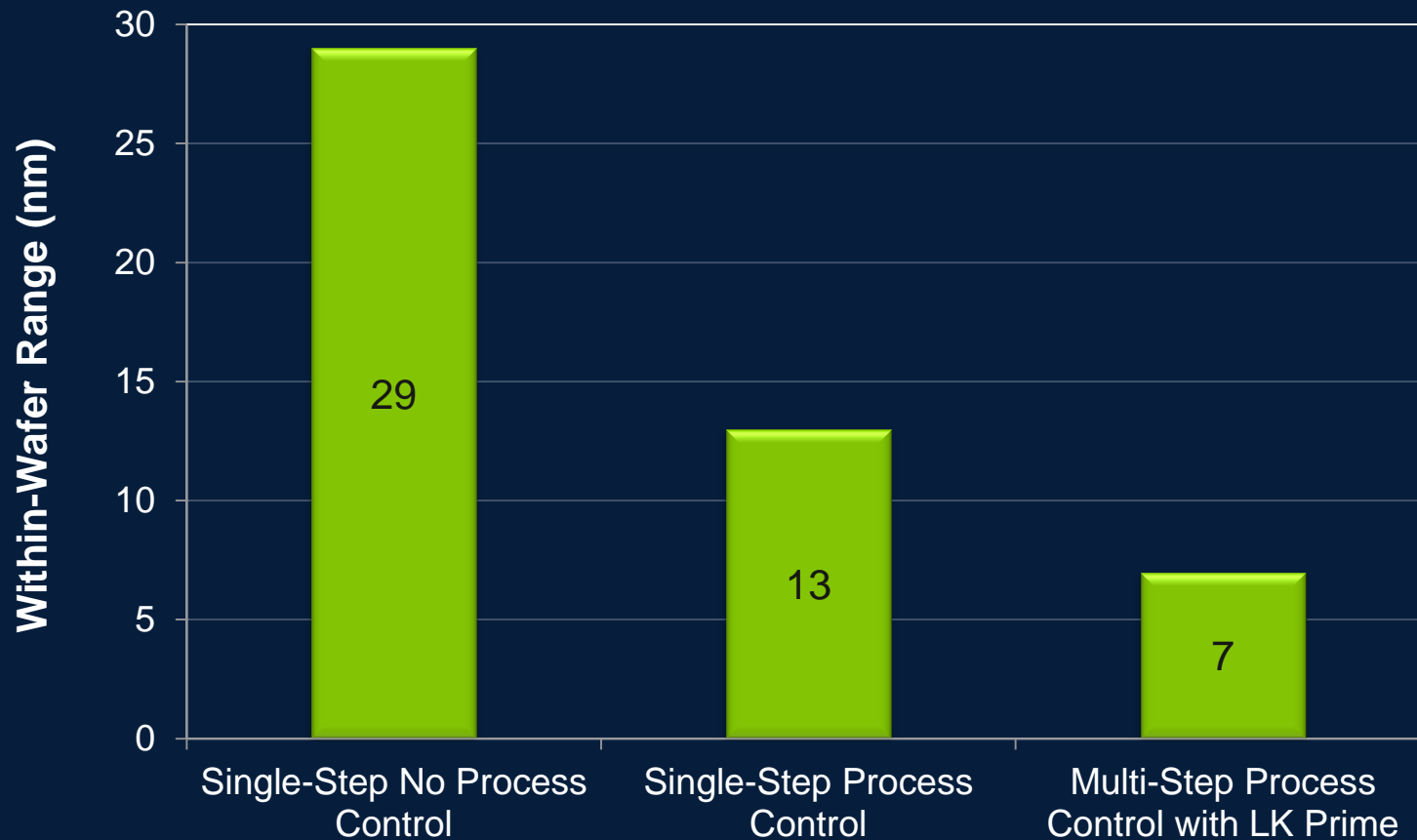


Multi-Step



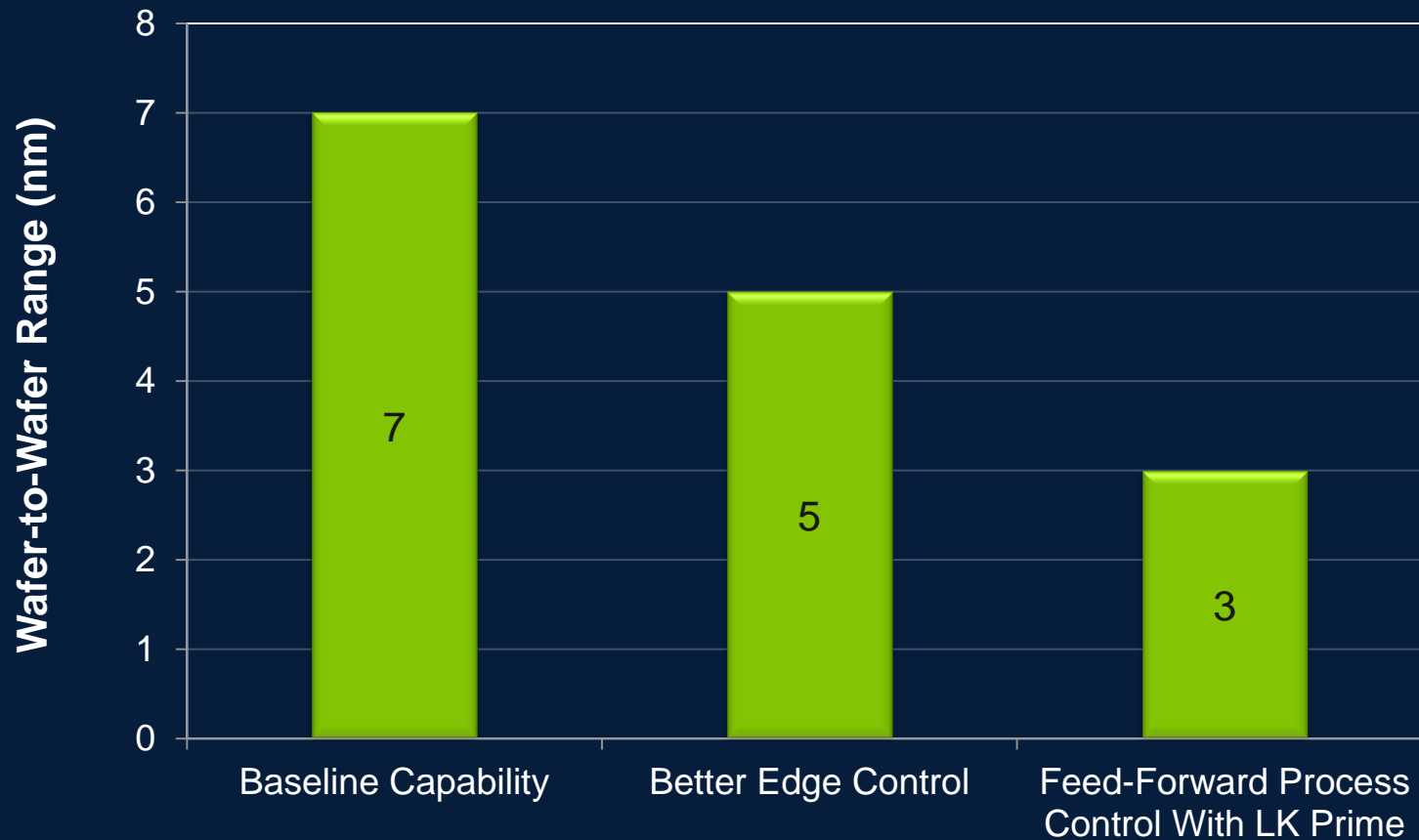
Multi-step polishing **stabilizes removal rate and profile**

Within-Wafer Poly FinFET Uniformity



LK Prime enables **nanometer-scale process control**

Wafer-to-Wafer Metal Gate Uniformity



LK Prime enables **nanometer-scale process control**

Applied Reflexion LK Prime CMP System

- Best On-Wafer Performance
 - Polish heads
 - In-situ process control
 - Chemical buff
- Highest Throughput Density
 - 14 processing stations
 - Up to 2x higher throughput
- Flexible and Extendible
 - Batch, parallel, and sequential processing
 - Multi-generation capabilities

Comprehensive CMP for 3D devices

